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(54) Transparent touch-sensitive panel.

(57) A signal input device which includes an operation panel (8) having an input area in which data are input by touching the operation panel, a plurality of sensors (S_1 to S_4) located at different places on the operation panel, the sensors receiving vibrations propagated from a touched point on the operation panel, a detection circuit (C_1 to C_4) for detecting times at which the sensors erceive the vibrations, an arithmetic means (45) for identifying the position of the touched point, a memory means (46) for storing numerical values whereby the input area is divided into a plurality of minor areas, and means (47,45) for judging which minor areas the touched points belong to, on the basis of the arithmetic results of the numerical values and data about the positions of the touched points.

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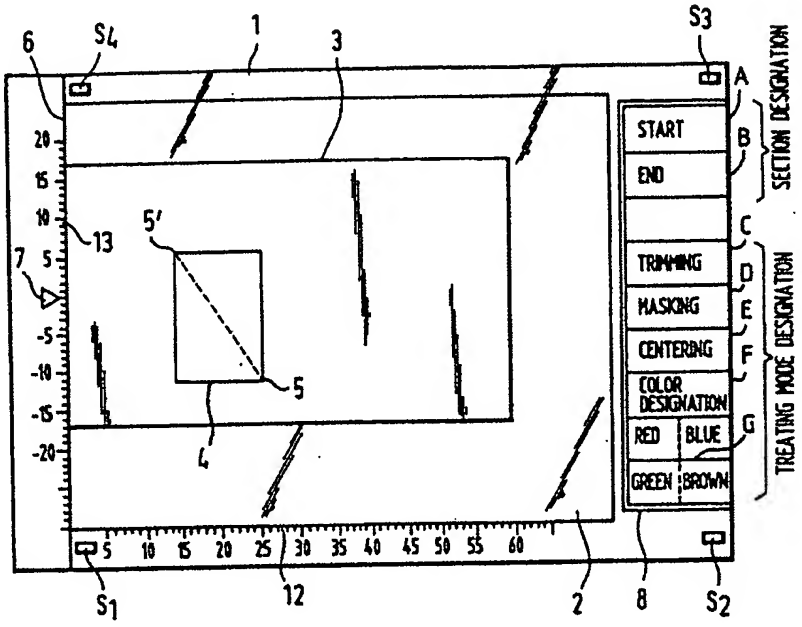
Fig.1


S4
1
3
S3
6
A
START
B
END
SECTION DESIGNATION
C
13
5'
7
TRIMMING
D
MASKING
E
CENTERING
F
COLOR DESIGNATION
RED
BLUE
G
GREEN
BROWN
TREATING MODE DESIGNATION
5
4
S1
12
2
8
S2

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates to a signal input device for inputting required data in response to points designated by touching a control panel.

2. Description of the Prior Art:

Various methods are in use for inputting data as signals:

One method is to use a key board on which data are input by keys. Each key is provided with a sensor (e.g. a contact switch) for detecting the input. This method is mainly used in electronic appliances. Another method is to use, in addition to the key board, a signal input device designed to designate an image-reading area or an image-non-reading area. This type of signal input devices adopt the following methods:

One method is for an operator to overlap a copying image on a lattice-scaled transparent sheet, and read the scales on the X-axis and Y-axis so as to input point by point through a ten-key key board.

Another is to mark scales along the X-axis and Y-axis on a glass plate on which an original is placed, and read the scales so as to enable an operator to input in response to points designated through a ten-key key board.

A third method is to provide arrays of switches equally spaced along the X-axis and Y-axis, respectively on an original glass plate, and enable an operator to input a coordinate designated by switches.

A fourth method is to provide a planar matrix array sensor on a cover covering an original, and to input into the sensor by an input pen.

The first and second methods can be economically achieved, but are not efficient in operation. The third method is also inefficient because of the dual operations of the X-axis and Y-axis.

The fourth method is more efficient than the other methods but disadvantageously costly because of the expensive matrix array. In addition, the glass plate must be completely transparent and exactly flat so as to avoid erroneous readings, and therefore, a special tray or the like must be used for supporting the matrix array sensor. The original must be shifted from the glass plate to the tray.

Japanese Laid-Open Patent Publication No. 63-244068 proposes a device which is used in cooperation with a ready-made original glass plate so as to designate copying parts of the original placed on the glass plate. This device includes an input pen incorporating an oscillator and at least three vibration detectors around the glass plate. When an operator touches the original glass plate with the input pen, the three detectors detect time intervals on the basis of reception of signals from the touching so as to specify the touching points. The 63-244068 Publication does not disclose a means or structure for specifying the touching points in detail but it is presumed that the cost will be reduced because a ready-made glass plate is used, and no key input device or matrix array is required.

The first and fourth method require an extra input device for inputting copying data in addition to a key input device for designating the inputting areas. The 63-244068 Publication discloses the designation of an imputting area but fails to disclose that the glass plate is used as the input device.

SUMMARY OF THE INVENTION

The signal input device of this invention, which overcomes the above-discussed and numerous other disadvantages and deficiencies of the prior art, comprises an operation panel including an input area in which data are input by touching the operation panel, a plurality of sensors located at different places on the operation panel, the sensors receiving vibrations propagated from a touched point on the operation panel, a detection circuit for detecting the time at which the sensors receive the vibrations, an arithmetic means for identifying the position of the touched point, a memory means for storing numerical values whereby the input area is divided into a plurality of minor areas, and means for judging which minor areas the touched points belong to, on the basis of the arithmetic results of the numerical values and data about the positions of the touched points.

Alternatively, a signal input device comprising a transparent glass panel a first area in which an original is placed and a second area in which the original is not placed, a plurality of sensors located at the second place, the sensors receiving vibrations propagated from a touched point on the glass panel, a detection circuit for detecting the time at which the sensors receive the vibrations, an arithmetic means for identifying the position of the touched point on the basis of the detected time, a memory means for storing the second area of the glass panel as an input area for allowing copying data to be input, means for judging to see

whether the position of a touched point identified by the arithmetic means is in the first area or not, on the basis of the data stored in the memory means, and a control means for using the result obtained by the judging means as input about the original when it arises from the first area or as input about copying data when it arises from the second area.

Alternatively, a signal input device for use in a copying machine, the device comprising an operation panel having an input area allowing a touched input therein, a plurality of sensors located at different places on the operation panel, the sensors receiving vibrations propagated from a touched point on the operation panel, a detection circuit for detecting time at which the sensors receive the vibrations, an arithmetic means for identifying the position of the touched point on the basis of the detected time, a memory means for storing numerical values whereby the input area is divided into a plurality of minor areas, means for judging which minor areas the touched points belong to, on the basis of the arithmetic results of the numerical values and data about the positions of the touched points, wherein the arithmetic means comprises means for starting the arithmetic operation by treating the received time detected by the detection circuit as effective, when the copying machine is in a stable operation state.

Thus, the invention described herein makes possible the objectives of (1) providing a signal input device which eliminates the necessity of providing switches and/or sensors corresponding to operation keys, (2) providing a planar type of signal input device, and (3) providing a signal input device easily attached to a copying machine.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention may be better understood and its numerous objects and advantages will become apparent to those skilled in the art by reference to the accompanying drawings as follows:

Figure 1 is a plan view showing a copying machine equipped with a signal input device of the present invention on the original glass plate thereof;

Figure 2 is a plan view showing another example of the signal input device of the present invention;

Figure 3 is a perspective view showing a copying machine equipped with the signal input device of Figure 2;

Figure 4 is a timing chart showing the operation of the signal input device of Figure 2, particularly to show shock waves being transmitted through the surface of a table glass or the substance thereof and reaching sensors;

Figure 5 is a block diagram used for the signal input device and the circuit of a copying machine;

Figure 6 is a flowchart exemplifying the steps of timing detection in the range of t_1 to t_4 in Figure 4;

Figure 7 is a flowchart showing the steps for seeking coordinates (X, Y) of designated points through arithmetic operation of the times t_1 to t_4 obtained from the flowchart of Figure 6;

Figure 8 is a flowchart showing the steps to be taken for detecting designated points prior to signal inputting;

Figure 9 is a flowchart showing the steps for checking areas where the detected input points are situated; and

Figure 10 is a top surface view showing another method of detecting input points.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figure 1, there is provided a transparent glass panel 1 having a copiable area 2 in which an original 3 can be copied. If the original 3 is placed out of the copiable area 2, it cannot be copied. A designating area 4 is provided, having diagonals 5 and 5'. The reference numeral 6 designates a reference line along which the forward end of the original 3 is placed, and the reference numeral 7 designates an index which indicates the center line of an image to be reproduced as the origin (0, 0).

An input panel 8 is located on the right side of the copying machine, through which various copying data and other necessary data are input. The input panel 8 is provided by printing on the top surface or the back surface of the glass panel 1. Necessary items are printed thereon. The input panel 8 can include several sections depending upon functions, such as sections A and B both for designating input points, sections C to F for designating treating modes, such as trimming, masking, centering, color designation, and section G for selecting color in accordance with the designation of a mode by the section F. In addition, it is possible to provide a ten-key key board for inputting digital data by a printing method. The glass panel 1 is additionally provided with reference scales 12 and 13 along the Y-axis and X-axis.

Sensors S_1 to S_4 are directly stuck to the front surface or the back surface of the glass panel 1 at each corner. These sensors S_1 to S_4 are to detect touched points by sensing vibrations propagated from the

touched point; more specifically, they detects the times for receiving signals.

An original is placed on the glass panel 1 whereby a designated point 5 of the original is input as a position signal to the copying machine. In this way a copying area is designated. Apart from this manner of designation, it is also possible to input copying data to the copying machine through the input panel 8, as follows:

Any point is touched on the glass panel 1, from which vibrations are propagated to each sensors S_1 to S_4. The sensors S_1 to S_4 detect or receive the vibrations at different times depending upon the distances from the touched points. The position of a touched point can be calculated by reference to a reference point; for example, the index 7. In this way, it is possible to recognize whether it is a touched point entered in the input panel 8 or the copiable area 2. In addition, the input panel 8 enables the operator to identify the particular position in the input panel 8 to be input by touching.

An operation of the signal input device of the present invention will be described as an example when it is used in a copying machine:

Step 1: An original 3 is placed in the copiable area 2 with the center line thereof aligned with the index 7 and with one edge thereof being alongside the reference line 6.

Step 2: The start area in the section A is touched by a pen, and then a state is reached in which the position of the original 3 can be designated. The designated area 4 is set by touching the two points 5 and 5'. When a plurality of designated areas are to be set, the above-mentioned procedure is repeated.

Step 3: When the designation is finished, the section B is touched so as to input the data obtained by Step 2 to the copying machine.

Step 4: Various treating modes such as trimming, masking, centering, color designating, etc, are operable on the original 3 after the position is designated by the above-mentioned procedure. These modes can be input in the respective sections C to F.

Then, the original 3 is turned upside down on the copiable area 2. The turned original 3 is set by being placed alongside the reference line 6, and then the print switch on the copying machine is pressed. In this way the copying is carried out in an input mode.

Referring to Figure 2, a modified example of the embodiment will be described:

The sensors S_1 to S_4 are provided at the center of each side of the copiable area 2, slightly spaced outside the respective sides. Two input panels 8 and 9 are provided on two sides (in Figure 2, the lower and the right sides) by printing so as to enable an operator to input by key. These two input panels 8 and 9 are provided on the same glass panel 1. The sensors S_1 and S_3 are on the X-axis and the sensors S_2 and S_4 are on the Y-axis, so as to locate the origin (0, 0) at the center of the copiable area 2.

The copying machine is equipped with an input section on the glass panel 1 through which required copying data are input, and a liquid crystal display section 10 is also provided. By touching the display, desired data can be input as displayed.

The input panel 9 includes a sections 9-1 and 9-2 for inputting digital data and starting the copying operation, respectively. The sections 9-1 and 9-2 are printed on the glass panel 1. The input data are displayed on the liquid crystal display section 10.

Figure 3 is a perspective view showing a copying machine equipped with the input device shown in Figure 2, wherein a cover 11 is opened.

Referring to Figure 4, the input device shown in Figure 2 is operated by touching a designated point P (X, Y) on the glass panel 1 with a pen or the like, the shock waves are propagated on the surface of the glass panel 1 or through it, and reach the respective sensors S_1 to S_4. The resulting timing chart is shown in the graph. t_0 shows a time when a designated point is touched, and t_1 to t_4 show times when the sensors S_1 to S_4 detect the shock waves. T_1 and T_2 show time differences in detection between the sensors S_1 and S_3, and between the sensors S_2 and S_4.

Referring to Figure 5, a circuit included in & copying machine equipped with the input device of the present invention will be described:

The sensors S_1 to S_4 convert the vibrations into electrical signals, and if this function is performed, any device such as piezo sensors, strain sensors, or mini-microphones can be used.

The sensor S_1 constitutes part of a detector circuit C_1 which includes an amplifier 41, a filter 42, a comparator 43 and a latch 44. The vibrations detected by the sensor S_1 are converted into electrical signals, and amplified into a predetermined voltage by the amplifier 41. The amplified voltage is trimmed by the filter 42 so as to remove unnecessary frequencies. Then the voltage is compared by the comparator 43 and when it reaches a predetermined value or exceeds it, it is detected as an effective signal, which is immediately sent to the latch 44. The time at which the effective signal comes out from the latch 44 is detected by a microcomputer (CPU) 45 which generates a reset signal R_1, thereby holding the output of the latch 44. The circuit C_1 is a detector circuit which comprises the arrangement from the sensor S_1 to the

latch 44. Likewise, circuits C_2 to C_4 are detector circuits including the sensors S_2 to S_4, respectively.

In addition, the CPU 45 is connected to a read-only memory (ROM) 46 which stores a required set of programs based on the data required to effect arithmetic calculation for identifying the designated point or points 4 and to execute the copying, the data being received from the input panels 8 and 9. The CPU 45 is also connected to a random access memory (RAM) 47 which temporarily stores the detected time of the sensors S_1 to S_4, the results of the arithmetic calculation for identifying the touched points, the copying data, and the copying state, an input/output port 48 which is used in increasing the number of input and output terminals and controlling same. A sensor group 49 including sensors S_5 to S_x, a key board 50, several driving elements 51, several control elements 52, an aural transmitter 54, and a driver 53 for driving the driving elements 51, the control elements 52 and the aural transmitter 54, and a display device (the liquid crystal display section 10) 55 are connected to the input/output port 48.

The CPU 45 outputs a signal which latches the latch 44 in the detection circuit C_i only when the copying machine is "ready" but does not output when the coping machine is in operation or at a rise-up or warm-up time, herinafter called "rise-up", after it is switched on. During this period of time, even if the sensors S_1 to S_4 detect vibrations and the effective signals are output by the comparator 43, these signals are ignored. While the copying machine is at a rise-up time or in operation, the sensors S_1 to S_4 indiscriminatelydetect every vibration such as vibrations inherent to the copying machine which are caused by the rotation of the photosensitive drum and the operation of various driving mechanism. To avoid detecting unnecessary vibrations, it is devised so that the signal detected by the CPU 45 is detected only at the "ready" state, and found to be effective, and then the arithmetic operation is started so as to identify touched points.

Any point P designated by touching is identified by arithmetic calculation in the following manner:

The program for this arithmetic operation is stored in the ROM 46, wherein the arithmetic operation is conducted by calculating time differences (shown in Figure 4) in detecting vibrations by the sensors S_1 to S_4.

In Figure 2, suppose that the coordinates of the sensors S_1 to S_4 are respectively (L, O), (O, L), (-L, O) and (O, -L), and that the coordinate of the designated point is (x, y). Vibrations are supposed to propagate through the glass panel 1 at a speed of v m/sec.

The propagating speed of vibrations through the glass panel depends upon the material and the manufacturing method of the glass panel 1, normally 3,000 to 4,500 m/sec, and in soda glass, it is about 4,300 m/sec.

Time difference T_1 in signal reception between the sensors S_1 and S_3 on the X-axis is equal to a value obtained by dividing the linear distances from the point P to the sensors S_1 and S_3 by the speed v. This relationship is expressed by the following equation:

$$T_1 = t_3 - t_1 = \frac{\sqrt{(L+x)^2 + y^2} - \sqrt{(L-x)^2 + y^2}}{v} \quad \ldots\ldots(1)$$

Likewise, time difference T_2 in signal reception between the sensors S_2 and S_4 on the Y-axis is equal to a value obtained by dividing the linear distances from the point P to the sensors S_1 and S_3 by the speed v. This relationship is expressed by the following equation:

$$T_2 = t_4 - t_2 = \frac{\sqrt{x^2 + (L+y)^2} - \sqrt{x^2 + (L-y)^2}}{v} \quad \ldots\ldots(2)$$

The equations (1) and (2) are simplified as follows:

$$y^2 = \frac{A_1}{B_1} x^2 - A_1 \qquad \ldots\ldots(3)$$

$$A_2x^2 - B_2y^2 + A_2B_2 = 0 \qquad (4)$$

From the equations (3) and (4), x and y are expressed by the following equations (5) and (6):

$$x = \pm\sqrt{\left| \frac{B_1B_2(A_1 + A_2)}{A_1B_2 - A_2B_1} \right|} \qquad \ldots\ldots(5)$$

$$y = \pm\sqrt{\left| \frac{A_1A_2(B_1 + B_2)}{A_1B_2 - A_2B_1} \right|} \qquad \ldots\ldots(6)$$

In the equations (5) and (6)

$$A_1 = \frac{L^2 - K_1^2}{2} \qquad A_2 = \frac{L^2 + K_2^2}{2}$$

$$B_1 = \frac{L^2 + K_1^2}{2} \qquad B_2 = \frac{L^2 - K_2^2}{2}$$

$$K_1^2 = \frac{T_1^2v^2}{2} - L^2 \qquad K_2^2 = \frac{T_2^2v^2}{2} - L^2$$

$\ldots\ldots(7)$

On the basis of the above-mentioned equations, the coordinate (x, y) of the point P designated by touching can be sought by arithmetic calculation. The arithmetic operation is effected by detecting the times t_1 to t_4 of the sensors S_1 to S_4 by the CPU 45 in accordance with the program stored in the ROM 46.

Referring to Figures 6 to 8, the manner of detecting the times t_1 to t_4 will be described:

As described above, the detection is ignored when the copying machine is at the rise-up time and in operation, and the arithmetic operation on the basis of vibration detection is not executed.

In Figure 8, the copying machine is switched on (start), and the rise-up or warm-up process starts at Flag F_1, continuing until the copying machine comes into the "ready" state, where, for example, the fixing section is energized, the photosensitive drum is put into idle rotation (for electrical charging or discharging) and any other preparatory operations are performed (toward the "ready" state). During this period, "Wait" is displayed, and inputs of any touched point are ignored.

When the copying operation is ready, "Ready" is displayed, and the sequence proceeds to the next Flag F_2. When a touched input is detected, it is judged to see if it arises in the printer start section. If it is

not, the touching input is again detected. If any area designation or copying data are input, the corresponding process is executed, and a touching input is detected. When the touching input is judged to be the printer start signal, Flag F_3 is executed so as to start the copying operation under the previously input copying data and the point designation. At this stage and thereafter until the copying operation is finished and the "Ready" state is restored, any touching input is ignored.

The treatment of a touched input at Flag F_2 will be described in detail by reference to Figure 6:

Step 01 is possible to start only when the operation panel is ready to be operated; for example, the copying operation is ready. This corresponds to Flag F_2 where a touched input is processed.

When the sequence is started, a timer TM starts, which counts by 0.1 μsec so as to allow an error in the range of ± 1 mm for identifying the position of a touched point. The reason is as follows:

$$1 \text{ mm} \div 4{,}300 \text{ m/sec} = 0.23 \ \mu\text{sec}$$

where 4,300 m/sec is an acoustic wave propagating speed of soda glass.

If the times sensed by the sensors are detected at two or more cycles, the tolerance is reduced to 1 mm or less. This allows a count unit of about 0.1 μsec.

Step 02 decides whether or not an effective signal I_1 comes from the sensor S_1. This effective signal means a signla which is recognized by the CPU 45 when it is input from the latch 44 in the detection circuit C_1 in Figure 5.

Step 03 decides whether a detecting Flag F_1 is on or not when the signal I_1 is detected.

Step 04 switches on Flag F_1 upon detection of the signal I_1, and the time of a timer TM is stored in a memory area M_1 of the RAM 47 as a detecting time t_1. Then, in order to fix the output of the latch 44 to "low", the output R_1 of the CPU 45 is turned on.

At Steps 05 to 07, if the signal I_1 is not detected at Step 02 or Flag F_1 is already on at Step 03 or all proceses at Step 04 are finished, the sequence proceeds to Step 05. The time t_2 of the sensor S_2 is detected by the same procedures followed from Steps 02 to 04.

At Steps 08 to 13, the times t_3 and t_4 of the sensors S_3 and S_4 are detected by the same manner.

Steps 14 judges Flags F_1 to F_4 as being on, if the detection of all the times t_1 to t_4 is finished from Steps 02 to 13, the sequence proceeds to Step 15. If any of the times t_1 to t_4 is not detected, the sequence returns to Step 20, and the time detecting program resumes from Steps 02 to 14.

Step 15 turns on the aural transmitter 54 when the detection of all the times t_1 to t_4 are finished, thereby informing the operator of the completion of the signal inputs.

In this way the times t_1 to t_4 at which the sensors S_1 to S_4 detect vibrations propagated from a touched point on the glass table 1 are recognized by the CPU 45, and the detected time t_4 is stored in the RAM 47.

The CPU 45 executes the process shown in the flowchart of Figure 7, and arithmetically processes the time t_1 in accordance with the equations (3) and (4). Thus, the coordinate (x, y) of the point P designated by touching is obtained.

At Step 16, the time t_3 stored in the RAM 47 is deducted from time t_1, and a time difference T_1 in detection between the sensors S_1 and S_3 on the X-axis is obtained, and the results are stored in a memory area M_5 of the RAM 47.

At Step 17, a time difference T_2 in detection between the sensors S_2 and S_4 on the Y-axis is obtained, and the results are stored in a memory area M_5 of the RAM 47.

At Step 18 x is calculated by equation (3) and at Step 19 y is calculated by equation (4). At Step 20 it is judged to decide which is earlier detected, the time t_1 or t_3. If the time t_1 is earlier detected, the calculated value x is stored as a plus value in a memory area M_x of the RAM 47. If the time t_3 is earlier detected, the x is stored as a minus value in a memory area M_x of the RAM 47.

Step 23 decides which is earlier detected, the time t_2 or t_4. If the time t_2 is earlier detected, at Step 25 the calculated value y is stored as a plus value in a memory area M_y of the RAM 47. If the time t_4 is earlier detected, at Step 25 the calculated value y is stored as a minus value in a memory area M_y of the RAM 47.

In this way, the coordinate (x, y) of the point P designated by touching is determined, and is stored in a memory area of the RAM 47. The position of the point P is identified on the glass panel 1 by reference to the program whereby the input comes from the input panels 8, 9 or from the copiable area 2. The last-mentioned determination is effected; for example, by setting the center of the copiable area 2 as the origin 0 (0, 0), and finding whether the touching occurs within the coordinates ($-X_{10}$ to X_{10}, $-Y_{n-1}$ to Y_{10}). If it is found to be from within these coordinate, it is judged that it comes from the copiable area 2.

The input panels 8 and 9 are printed at places away from the copiable area 2, that is, right-ward of the sensor S_1 ($L < X_{10}$, where L is on the X-axis), and downward of the sensor S_1 ($-L < -Y_n$, where -L is on the Y-axis). The K_1 to K_n on the input panel 8 are input keys whereby copying data such as the designation of a

designated area for an original and the selection of copying modes, are input, wherein the key K_n is allotted to the operation of the copyings. Therefore, K_1 can optionally allocated to regions Y_{10}, and K_2 is allocated to regions Y_9 to Y_8.

In the input panel 9, it is arranged that the value 1 corresponds to a region $-X_2$ to $-X_1$, the value 2 corresponds to a region $-X_1$ to 0, the value 3 corresponds to a region 0 to X_1 and so on. These regions are previously stored in the ROM 46, in which items corresponding to the respective regions are stored.

Referring to Figure 9, a signal input will be described at a point P designated by touching. Figure 9 shows a flowchart whereby it is judged which region in the RAM 47 the position calculated in Figure 7 belongs to, thereby finding whether the signal is input as a key input from the input panels 8 and 9 or else as a designation of area. Moreover, the input key is also identified in the memory.

At Step 30 the value of the counter i is set to 1. This counter i shows an area within the input panel 8, and corresponds to the number of keys in the input panel 8. The counter has a range from 1 to n so as to correspond to the keys K_1 to K_n of the input panel 8 allotted to the coordinates Y_{10} to Y_n. The ROM 46 reads the coordinates Y_{10} to Y_n which correspond to the number of the counter i.

Step 31 decides whether the M_x on the X-axis for the detected point P is larger than the X_{10} stored in the ROM 46. If it is found to be larger, Step 32 decides whether the M_y on the Y-axis is between the Y_{10} and Y_9 stored in the ROM 46.

At Step 34, if it is found to be between the Y_{10} and Y_9, Step 33 decides that it is the key 1. If it is not between the Y_{10} and Y_9, Step 33 adds "1" to the counter i so as to achieve (i = 2).

Step 35 decides whether the counter i exceeds the number of keys. If it does not exceed it, the sequence returns to Step 32 where it is decided whether it is between Y_9 and Y_8. If it is between Y_9 and Y_8, Step 33 decides that it is key K_2.

The above-mentioned judgement is repeated until the counter i becomes n, thereby enabling any of the keys K_1 to K_n to be designated.

Step 36 decides that an exact region has not been designated if the counter i exceeds, and displays "input again" through the display 55.

Steps 37 to 42 shows a flowchart whereby it is detected that the ten-key key board 9-1 and the display 10 are designated. In the same manner as Steps 32 and 36 any of the keys KY_1 to KY_m has been designated.

At Step 43, if the values of M_x and M_y are found to be below X_{10} and Y_{10} at Steps 31 and 37, the coordinate (M_x, M_y) of the point P designated by touching is displayed on the display 55 as numerals corresponding to the scales 13 and 14 printed along the glass panel 1, wherein the point P is evidently designated by touching in the copiable area 2. If two touched points are found, the rectangle having a diagonal as shown in Figure 1 is input as a signal area.

In this way the position of the glass panel is identified by a point designated by touching the glass panel, and a signal is input corresponding to the designated area. The signal input device can per form level inputting, that is, input data about an image area of an original and other copying data to the copying machine from surface to surface.

Figure 10 shows a further example which is provided sensors S_3 to S_4 located adjacent to each end of the reference line 6 of the glass panel 1, which are bondaries of the copiable area), and S_1 and S_2 located at two apexes of a square with a side extending from $S_3$to S_4 and arranged in a counter-clockwise direction. The origin is placed at the center of this square, and the OS_1 is the X-axis, and OS_2 is the Y-axis. In the coordinates a touched point P has the coordinate (x, y). The direction from a middle point between the sensors S_3 and S_4 to the origin 0 is X', and the direction perpendicular to the X'-axis and extending from the origin 0 to a middle point between the sensors S_2 and S_3 is Y'-axis. Suppose that the coordinate of the point P on the X' and Y' axes is (X, Y). Then, an angle XOX' θ becomes 45°, and the following equations are established, which can be used for converting the coordinate in Figure 2:

$$X = \frac{1}{\sqrt{2}}(x + y) \qquad \ldots\ldots(8)$$

$$Y = \frac{1}{\sqrt{2}}(-x + Y) \qquad \ldots\ldots(9)$$

By using these equations (8) and (9), the position of the point P can be calculated in the same arithmetic manner as described with respect to Figure 2.

Under this arrangement of the sensors, in which they are arranged on the boundaries with an image area, so that they do not prevent the formation of an image. In addition, since the sensors are located on the bondaries of the copiable area on the glass panel 1, precision is achieved.

It is understood that various other modifications will be apparent to and can be readily made by those skilled in the art without departing from the scope and spirit of this invention. Accordingly, it is not intended that the scope of the claims appended hereto be limited to the description as set forth herein, but rather that the claims be construed as encompassing all the features of patentable novelty that reside in the present invention, including all features that would be treated as equivalents thereof by those skilled in the art to which this invention pertains.

Claims

1. A signal input device comprising an operation panel (8) including an input area in which data are input by touching the operation panel, a plurality of sensors (S_1 to S_4) located at different places on the operation panel, the sensors receiving vibrations propagated from a touched point on the operation panel, a detection circuit (C_1 to C_4) for detecting times at which the sensors receive the vibrations, an arithmetic means (45) for identifying the position of the touched point, a memory means (46) for storing numerical values whereby the input area is divided into a plurality of minor areas, and means (45,47) for judging which minor areas the touched points belong to, on the basis of the arithmetic results of the numerical values and data about the positions of the touched points.

2. A signal input device comprising a transparent glass panel (1) a first area (2) in which an original (3) is placed and a second area (8) in which the original is not placed, a plurality of sensors (S_1 to S_4) located at the second area the sensors receiving vibrations propagated from a touched point on the glass panel, a detection circuit (C_1 to C_4) for detecting times at which the sensors receive the vibrations, an arithmetic means (45) for identifying the position of the touched point on the basis of the detected times, a memory means (46) for storing the second area of the glass panel as an input area for allowing copying data to be input, means (47,45) for judging to see whether the position of a touched point identified by the arithmetic means is in the first area or not, on the basis of the data stored in the memory means, and a control means for using the result obtained by the judging means as input about the original when it arises from the first area or as input about copying data when it arises from the second area.

3. A signal input device for use in a copying machine, the device comprising an operation panel having an input area allowing a touched input therein, a plurality of sensors located at different places on the operation panel, the sensors receiving vibrations propagated from a touched point on the operation panel, a detection circuit for detecting times at which the sensors receive the vibrations, an arithmetic means for identifying the position of the touched point on the basis of the detected times, a memory means for storing numerical values whereby the input area is divided into a plurality of minor areas, means for judging which minor areas the touched points belong to, on the basis of the arithmetic results of the numerical values and data about the positions of the touched points, wherein the arithmetic means comprises means for starting the arithmetic operation by treating the received times detected by the detection circuit as effective, when the copying machine is in a stable operation state.

Fig.1

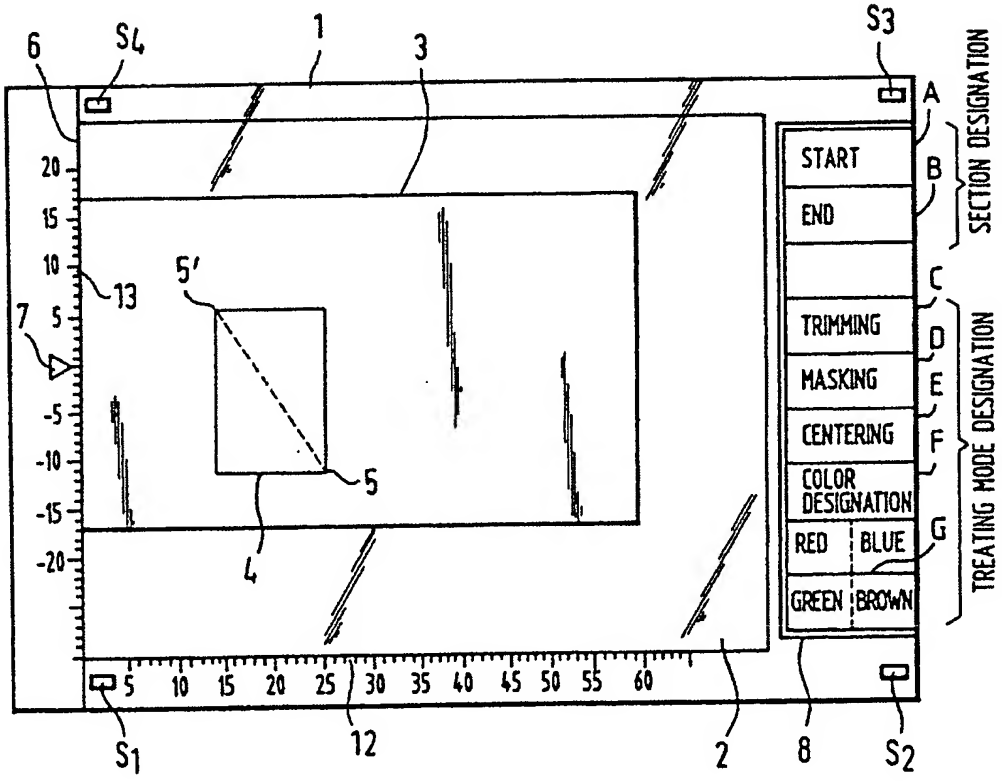

6
S4
1
3
S3
A
START
B
END
SECTION DESIGNATION
C
TRIMMING
D
MASKING
E
CENTERING
F
COLOR DESIGNATION
RED
BLUE
G
GREEN
BROWN
TREATING MODE DESIGNATION
20
15
10
13
5'
7
5
-5
-10
-15
-20
5
4
5 10 15 20 25 30 35 40 45 50 55 60
S1
12
2
8
S2

Fig. 2

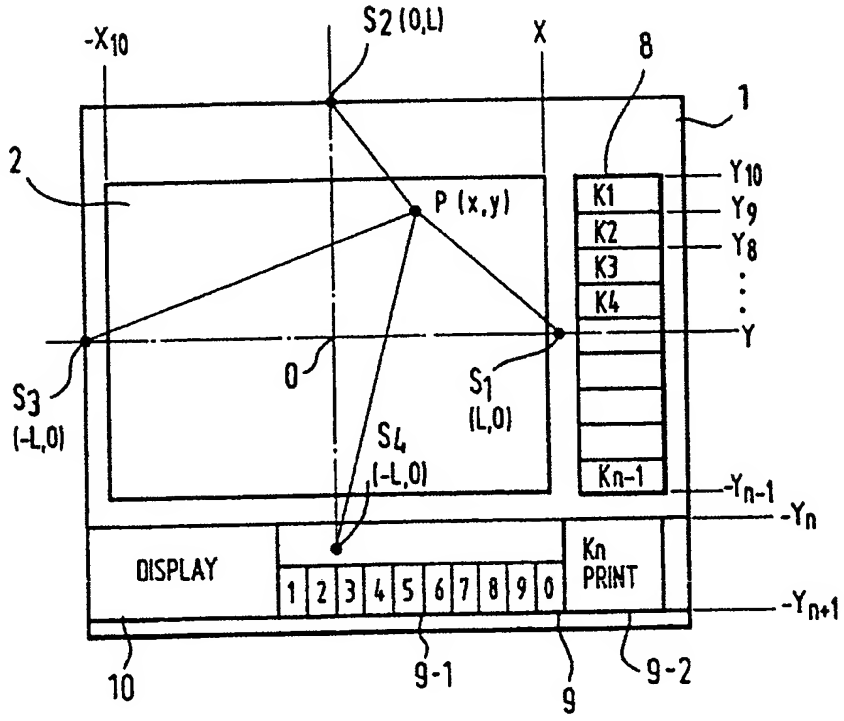

-X10
S2 (0,L)
X
8
1
2
P (x,y)
K1
K2
K3
K4
Kn-1
Y10
Y9
Y8
Y
-Yn-1
-Yn
-Yn+1
0
S3
(-L,0)
S1
(L,0)
S4
(-L,0)
DISPLAY
1 2 3 4 5 6 7 8 9 0
Kn
PRINT
10
9-1
9
9-2

Fig.3

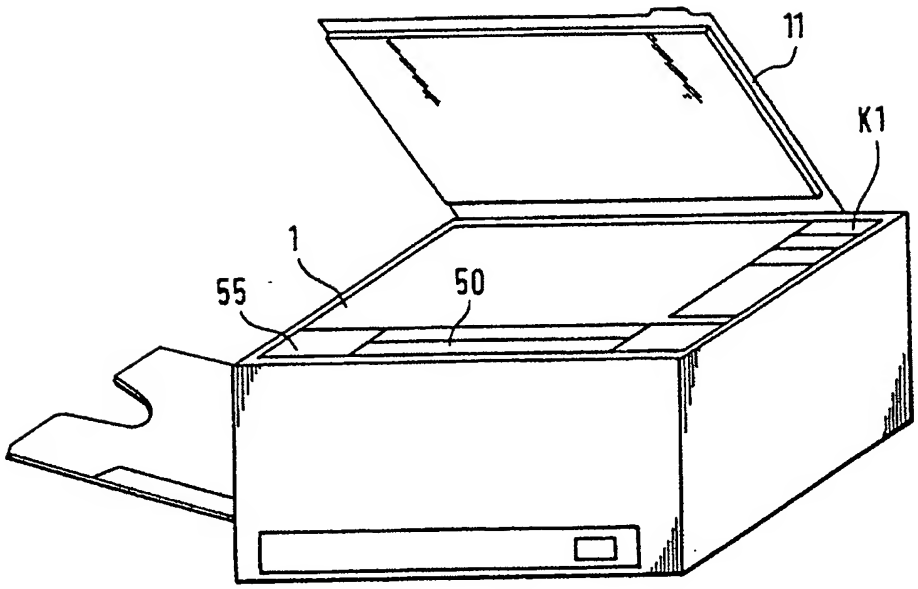


Fig.4

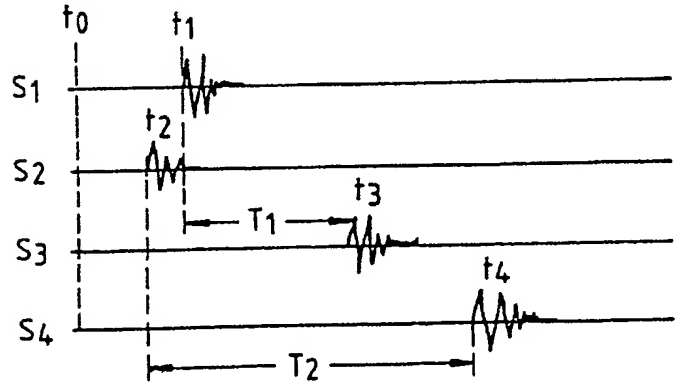


Fig. 5

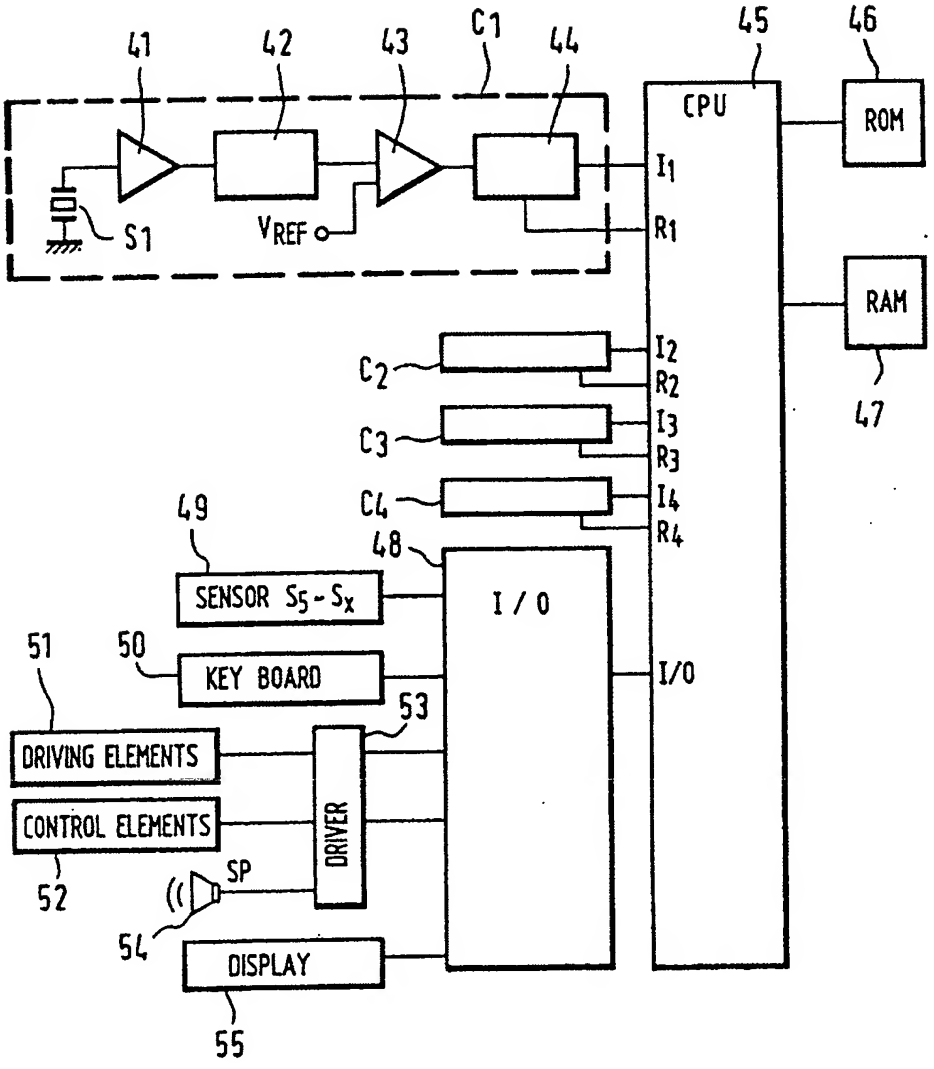

41
42
43
C1
44
45
46
CPU
ROM
S1
VREF
I1
R1
RAM
C2
I2
R2
47
C3
I3
R3
C4
I4
R4
49
48
SENSOR S5 - Sx
I / O
51
50
KEY BOARD
I/O
53
DRIVING ELEMENTS
CONTROL ELEMENTS
DRIVER
SP
52
54
DISPLAY
55

Fig.6

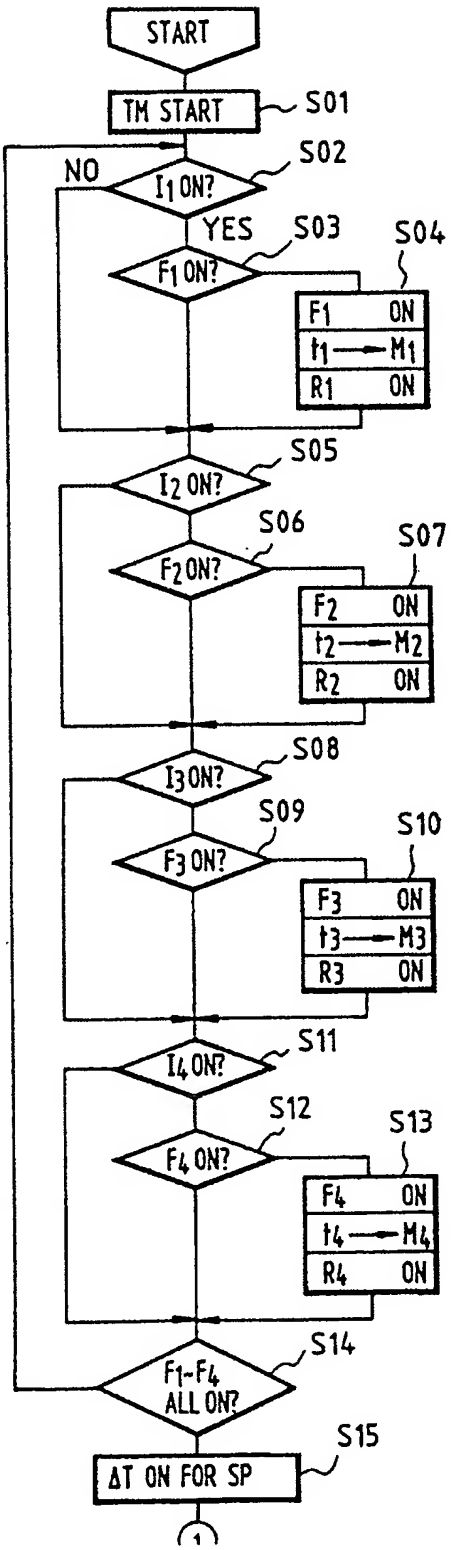

START
TM START
S01
S02
NO
I1 ON?
YES
S03
F1 ON?
S04
F1 ON
t1 → M1
R1 ON
S05
I2 ON?
S06
F2 ON?
S07
F2 ON
t2 → M2
R2 ON
S08
I3 ON?
S09
F3 ON?
S10
F3 ON
t3 → M3
R3 ON
S11
I4 ON?
S12
F4 ON?
S13
F4 ON
t4 → M4
R4 ON
S14
F1~F4 ALL ON?
S15
ΔT ON FOR SP
1

Fig.7

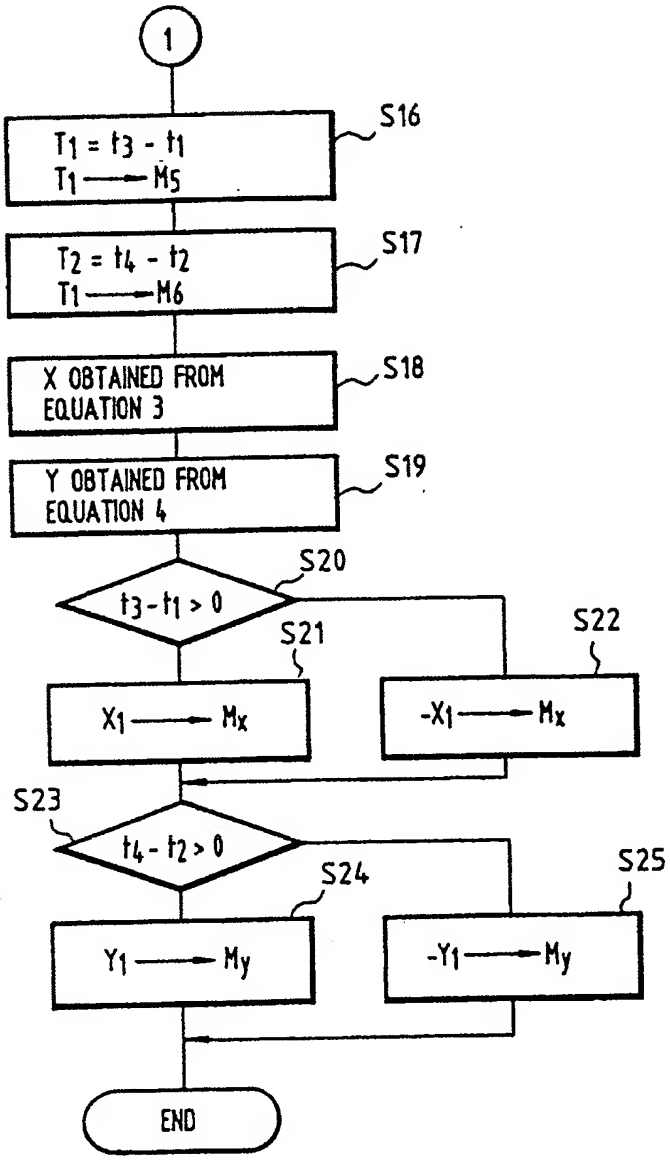

1
T1 = t3 - t1
T1 ⟶ M5
S16
T2 = t4 - t2
T1 ⟶ M6
S17
X OBTAINED FROM EQUATION 3
S18
Y OBTAINED FROM EQUATION 4
S19
t3-t1 > 0
S20
S21
X1 ⟶ Mx
S22
-X1 ⟶ Mx
S23
t4 - t2 > 0
S24
Y1 ⟶ My
S25
-Y1 ⟶ My
END

Fig.8

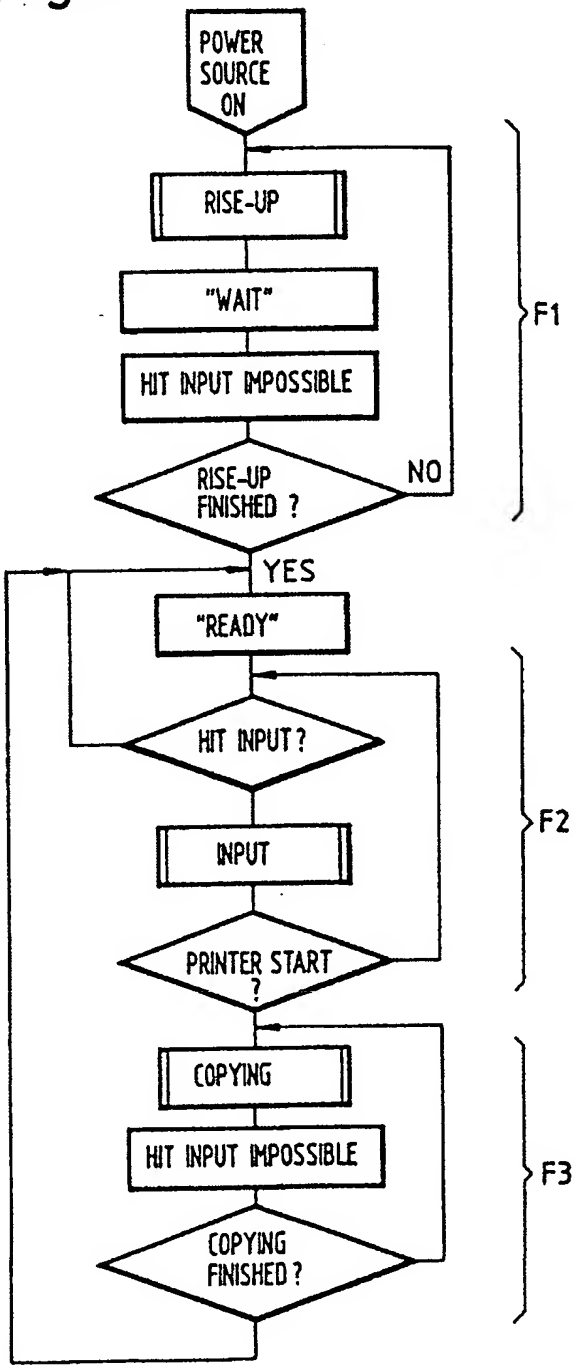

POWER SOURCE ON
RISE-UP
"WAIT"
HIT INPUT IMPOSSIBLE
RISE-UP FINISHED ?
NO
YES
"READY"
HIT INPUT ?
INPUT
PRINTER START ?
COPYING
HIT INPUT IMPOSSIBLE
COPYING FINISHED ?
F1
F2
F3

Fig.9

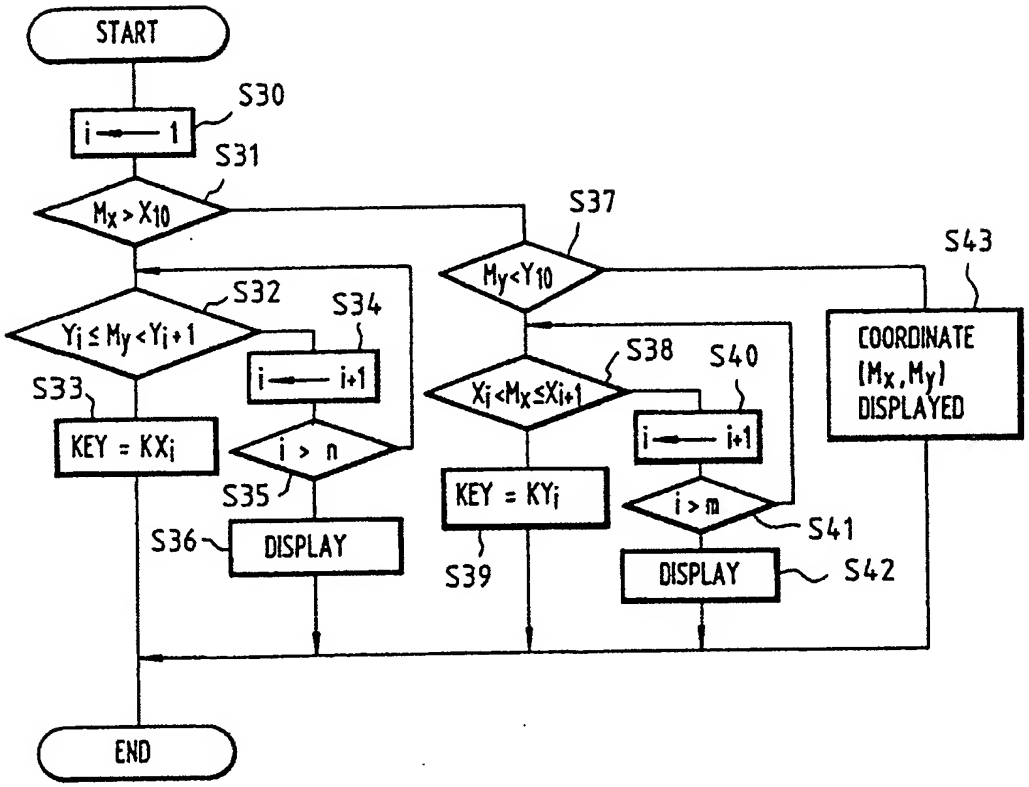

START
S30
i ← 1
S31
Mx > X10
S37
My<Y10
S43
COORDINATE (Mx, My) DISPLAYED
S32
Yi ≤ My < Yi+1
S34
i ← i+1
S33
KEY = KXi
i > n
S35
S36
DISPLAY
S38
Xi<Mx≤Xi+1
S40
i ← i+1
KEY = KYi
S39
i > m
S41
DISPLAY
S42
END

Fig.10